Course Code	Course Title	L	T	P	C
BCLE215L	**Waste Management**	**3**	**0**	**0**	**3**
Pre-requisite	**NIL**	**Syllabus version**			
		1.0			

Course Objectives

The objectives of this course is to :

1. Understand the different sources of the waste.
2. Analyse the socio-economic and environmental factors for waste management.
3. Imply the shift of waste management in the closed loop approach.

Course Outcomes

Upon completion of this course, the student will be able to :

1. Understand the potential impacts of waste management.
2. Develop the environmental, social and economic framework towards sustainable development.
3. Apply sustainable development tools in regulating the waste management.
4. Implement life cycle analysis in waste management.
5. Involve in the concepts of closed loop approach and circular economy.

Module:1	**Introduction to Waste Management**	**5 hours**

Perspective of waste generation–Sources, impacts, characteristics, segregation and disposal of waste-Linear economy –Urbanization and new challenges in waste management–Problems associated with the waste-Relevant Regulations.

Module:2	**Municipal Solid Waste Management**	**7 hours**

Sources; composition; generation-Rates; collection of waste; separation-Transfer and transport of waste-Treatment and disposal options-Landfill-Bio-mining-Incineration-Biomedical waste-Source, generation and classification-Waste management and reduction techniques.

Module:3	**Hazardous Waste Management**	**6 hours**

Characterization of waste-Compatibility and flammability of chemicals-Storage-Transport-Secured Landfills-Treatment techniques-Fundamental concepts on fate and transport of chemicals-Health effects.

Module:4	**Radioactive Waste Management**	**6 hours**

Sources, measures and health effects-Nuclear power plants and fuel production-Waste generation from nuclear power plants–Low level and high level waste-Management-Radiation standard by ICRP and AERB-Regulatory framework.

Module:5	**Wastewater Management**	**5 hours**

Sources and characteristics of wastewater–Primary wastewater treatment–Secondary wastewater treatment–Sludge treatment alternatives–Industrial wastewater treatment–Zero Liquid Discharge–Wastewater disposal methods.

Module:6	**Emerging waste**	**9 hours**

Sources and Characteristics of Plastic waste, marine plastic waste, microplastic, E-waste, Agriculture waste, Glass waste, Metal waste, Oil and gas exploration and production of waste, Space waste, Construction material waste-Recycling non-biodegradable waste, Tyre recycling, End of life textiles, Recovery of value added products, Reuse of waste.

Module:7	**Closed Loop Approach Towards Circular Economy**	**5 hours**

Introduction to the Circular Economy-Transition from Linear to Circular Economy-Closed loop supply chain–Integrated waste refinery-Sustainable Development Goals (SDGs)-

Circular Economy policies towards Sustainable Development.		
Module:8	**Contemporary issues**	**2 hours**
Total Lecture Hours		**45 hours**
Text Book(s)		
1. Salah M. El-Haggar, Sustainable Industrial Design and Waste Management Cradle-to-cradle for Sustainable Development, 2007, Elsevier Academic Press, USA.		
Reference Books		
1. Trevor M. Letcher and Daniel A. Vallero, Waste- A Handbook for Management, 2019, Second Edition, Elsevier Academic Press, USA. 2. Alexandros Stefanakis and Ioannis Nikolaou, Circular Economy and Sustainability Volume 2: Environmental Engineering, 2021, First Edition, Elsevier Academic Press, USA.		
Mode of Evaluation: CAT, Assignment, Quiz, FAT.		
Recommended by Board of Studies	24.02.2022	
Approved by Academic Council	No. 66	**Date** 16-06-2022